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SCIENCE AND TECHNOLOGY

No. 158



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CHINA REPORT

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NATIONAL DEVELOPMENTS

'RENMIN RIBAO' DISCUSSES PROMOTING SCIENCE, TECHNOLOGY

HK311142 Beijing RENMIN RIBAO in Chinese 22 Mar 82 p 5

[Article by Hu Ping [5170 1627] and Deng Nan [6772 2809]: "In the Face of the New Situation--Looking Back on the Implementation in the Past Year of the New Policy for Scientific and Technological Development and Looking Forward to Its Prospects"; passages within slantlines denote boldface as published]

[Text] At present, an upsurge of relying on science and technology to promote economic and social development is in the making throughout the country. The strategic thinking of "economic and social development must rely on science and technology, and science and technology must serve economic and social development" is beginning to take root in the hearts of the people. Science and technology as an effective means of policymaking and as a powerful function of productive forces have become increasingly apparent in both the macro and micro aspects.

Since the founding of the People's Republic, several upsurges have appeared in the development of our scientific and technological undertakings. In 1956, following the development of large-scale economic construction, the first upsurge of the "march toward science" appeared in our country, and important results were achieved. Unfortunately, it was very quickly interrupted by the political movement which followed. The national scientific and technological work conference convened in Guangzhou in 1962 cleared up the "leftist" mistakes of the latter part of the 1950's and adopted a series of measures to consolidate and strengthen scientific and technological work. There was a new development in scientific and technological undertakings. However, the "great cultural revolution" which began in 1966 again caused a new and greater setback to scientific and technological undertakings. The national science congress held in 1978 was a great turning point in the development of scientific and technological undertakings in China. This congress thoroughly criticized politically the long-standing "leftist" abuses which seriously fettered the development of scientific and technological undertakings for many years, implemented the party's policy for intellectuals as well as other policies and expounded that science and

technology is the Marxist principle of productive forces. This had a far-reaching impact on the development of scientific and technological undertakings in China. However, the inadequacy was, this congress did not directly link up the development of science and technology with economic and social development and did not put forward the effective method and measure of relying on science and technology to promote economic and social development.

The new policy for scientific and technological development put forward by the CCP Central Committee in 1981 hallmarked a new stage in the development of scientific and technological undertakings in China. The central idea of this new policy is to strengthen close integration and coordinated development between science and technology and the economy and society. Under the impetus given by this new policy for scientific and technological development, new changes have appeared on the scientific and technological front in the past year.

/1. Many party and government leaders from the Central Committee to the localities have paid attention to further strengthening scientific and technological work./ This kind of attention is no longer just verbal. They are beginning to regard the development of scientific and technological work as an important component in the development of strategy. Many districts and departments throughout the country have already integrated science and technology with the economy, and proceeding from the economic characteristics and industrial superiority of their own district and department, formulated an overall plan for the coordinated development of science and technology and economy. They have determined the orientation and problem of scientific research according to the needs of economic development, and at the same time, also relied on science and technology to tap latent productive capacity and to carry out a technical restructuring of the national economy. They have obtained definite results in getting resources, energy, quality, output and economic returns from science and technology. Facts have shown that the development of science and technology is no longer a not very essential "soft" task, but it is a "tough" task capable of affecting the overall situation.

/2. The broad masses of scientific research units as well as scientists and technicians have heightened their consciousness of serving economic and social development and further defined the basic goal and orientation of developing science and technology./ While steadily strengthening basic research, China at present has concentrated its main force on applied research and developmental research. Many units have readjusted the problems and items of scientific research, strengthened direct ties with production departments, accepted research tasks and assignments from production departments, supplied technical advice and service to the whole society and gradually developed the orientation of scientific research to meet the needs of society. This has not only effectively promoted the development of production, but has also stimulated the work of the units themselves.

/3. The role of scientists and technicians in modernization is being further respected./ They are not only bringing their specialities into play in such concrete work as scientific research, planning and production, but they are also playing an important role in the strategic policymaking of the whole district, the whole department and even the whole country. Some policymaking organs are beginning to pay attention to hearing the views of scientists and specialists and carrying out a feasibility study before they adopt an important measure. Some scientists and specialists with organizational and administrative ability have joined leading bodies at various levels.

/4. There has been new progress in the popularization and application of scientific and technological achievements./ As a result of implementing the principle of "four shiftings" (shifting scientific and technological achievements from the laboratory to production, shifting from advanced areas in the country to backward areas, shifting from military use to civilian use and shifting from outside the country to inside the country), the scientific and technological achievements of many places no longer remain at the "sample, souvenir and exhibit" stage but can be more quickly applied in production. Many new forms of technical transformations, such as various forms of contract systems, compensative technological transfers, scientific research and production joint ventures, technical advice and services, and technical achievements fairs have been created in practice.

/5. Great developments have taken place in the work of enterprise-run scientific research./ After expanding the decisionmaking power of enterprises and setting up the economic responsibility system, many enterprises changed their long-standing tendency of neglecting the technical structure of the past and showed a greater interest in product and technical quality. According to the investigation of some provinces and municipalities, among the important technological achievements scored in 1981, about one-third to one-half were supplied by enterprise-run scientific research projects. State-run scientific research has distinctive characteristics and superiority and can quickly provide economic returns. Some of the enterprises, which were always operating at a loss, have quickly turned losses into profits and changed their features because of a breakthrough in technology.

/6. A new upsurge in studying and applying science has appeared in the vast countryside./ The agricultural production responsibility system has greatly aroused the demand of the broad masses of peasants for "scientific farming." Apart from the existing agricultural techniques stations in the countryside, there are now such new things as "agricultural science households," and they are playing a hardcore as well as exemplary role in scientific farming. In the past years, various measures have been adopted in many districts throughout the country to extensively popularize the achievements of scientific research in agriculture and notable economic results have been achieved. There is a marked improvement in the position of agricultural scientific and technical cadres and they are generally welcomed by the peasants.

/7. The channels of scientific research funds are beginning to develop toward diversification./ In the past, scientific research funds came under the unified allocation of state financial departments and the amount of funds had no direct connection with the economic returns of scientific research achievements. At present, the economic returns of scientific research achievements receive widespread attention from society. Scientific and technological investment has now become a "ten thousandfold profit" matter. The channels of investment have become increasingly diversified. Apart from unified state financial allocations, many localities, departments and enterprises have in varying degrees all squeezed out funds for scientific and technological investment. Moreover, the additional income obtained by the scientific research units from the transfer of technology, supply of technical services and sales of scientific research achievements and trial-manufacture products has also become an important source of funds for the scientific research units.

/8. There is a new way for the rational circulation of qualified scientific and technical personnel./ As regards the employment of scientific and technical personnel, apart from unified assignment by personnel departments, some localities have been experimenting with "rational circulation" within a given framework. Some have "invited applications" for technical guidance from scientific research units and institutions of higher learning. Some have formed "joint ventures" with provincial, municipal and enterprise research units and used outside scientific and technical forces to serve the production of their own province and municipality.

/9. Large numbers of newly emerging medium-size and small towns, which relied on science and technology to quickly change their features, have appeared throughout the country./ The 60 percent increase in profits and the 40 percent increase in output of some urban industries have been obtained from technical progress. These towns have one distinguishing feature in common, and that is, they have really given prominence to scientific and technological work in the modernization and have given an impetus to the whole economy and to the rapid development of industrial production in particular.

/10. There have been great developments in the study of scientific and technical policies./ Last year, China held two national conferences for the study of scientific and technical policies. At present, almost all provinces and municipalities throughout the country have set up organs for the study of scientific and technical policies. Quite a few districts and departments have set up research organs for the study of science. These organs and organizations have, on the basis of conducting a vast amount of investigation and study, put forward many important views and suggestions on implementing the new scientific and technical policies, restructuring our scientific and technical management system, studying our strategy for social and economic development and forecasting the trends of scientific and technical as well as economic development both at home and abroad.

Naturally, we should see that the implementation of the new policy for our scientific and technological development is only just beginning. There are still many problems and difficulties. After the implementation of the new scientific and technical policies, there will be corresponding changes in our scientific and technical management system, scientific research and planning system, scientific research funds management method and scientific and technical personnel management method.

In the face of this new situation, our comrades on the scientific and technical front hold that we must first grasp the following links:

Change the Outmoded Work Method of Responsible Scientific and Technical Departments

In implementing the new policy for scientific and technological development, there should be a big change in the leadership style and work method of the scientific and technical departments at various levels. They must break away from the former habit of limiting themselves to a narrow circle of departments and from the same old ways of administrative management and document reports. They must closely cooperate with other departments and grasp important problems relating to economic and social development together. Everything from determining economic targets, reforming the economic structure and deploying productive forces in a rational manner to surveying and utilizing resources in a rational manner, restructuring the technology of enterprises and drawing up technical and economic policies should be grasped. They must enliven their thinking, enliven scientific research organs and enliven activities for finding ways of making money for scientific research. They must grasp policies, coordination, industrial superiority, uniting scientific research and production and popularizing scientific research achievements. By means of investigation and study and the carrying out of guidance according to category, they must unify various tasks on the path of closely integrating science and technology with coordinated economic and social development.

Continue To Grasp Properly the Work of 'Four Shiftings'

The carrying out of the "four shiftings" is the scientific summing up of both the positive as well as negative aspects of the experiences of our scientific and technological work in the last 30 and more years. The present question is how to quickly, effectively and persistently carry out this kind of change. This involves restructuring the economic system of the state and also involves the economic policy, tax policy, price policy, credit policy, technological secrets policy and patent right system of the state. At present, many forms of shifting have been created in various parts of the country. However, most of them are still at the primary stage. We must continue to improve them, theoretically explain them, systematically perfect them and set up laws to protect them.

Organize Forces To Make a Concentrated Attack on Science and Technology

At present, in the solving of some important scientific research problems; there are still such defects as duplication, dispersed manpower and lack of unified planning and coordination in many departments and districts. Experiences from both at home and abroad have indicated that in order to solve important scientific and technical problems, we must organize the forces of various sectors, rationally carry out distribution of labor and cooperate in making a concentrated attack before we can get double the result with half the effort. For the sake of organizing properly a concentrated attack, we must first select a number of projects, make proper arrangements for funds, materials and manpower, define responsibilities and strictly carry out periodic inspections. Not only key projects of a national nature must carry out work in this way, but some of the projects of a departmental or regional nature must also carry out work in this way. In the concentrated attack, responsible scientific and technical departments must closely cooperate with the departments and units concerned and actively bring their organizing and coordinating role into play.

Actively and Reliably Carry Out the Restructuring of the Scientific and Technical Management System

Following the implementation of the new policy for scientific and technological development, certain contradictions in the scientific and technical management system have become more clearly exposed. The restructuring of the scientific and technical management system has become imperative. This kind of restructuring deals with a wide range of sectors including perfecting scientific research planning, expanding the decisionmaking power of scientific research units, implementing compensative technological transfer, perfecting the scientific research contract system, diversifying the channels of scientific research funds and using qualified scientific and technical personnel in a rational manner. Even though our country is still in the period of readjusting at present and all-round restructuring cannot be carried out, we should actively create conditions by beginning to restructure the parts which are already matured, accumulate experiences and gradually popularize them. We cannot passively wait. If a unified method for the whole country cannot be formulated to solve some of the problems for the time being, we could formulate some provisionsal rules and regulation based on the actual situation of our own district or department to expedite the development of work.

Strengthen the Study of Scientific and Technical Policies

The study of scientific and technical policies is a kind of comprehensive research spanning departments and disciplines and involving the fields of politics, economics, society, science and technology and education.

Experiences in many countries have indicated that the study of scientific and technical policies has a very important bearing on the development of scientific and technological undertaking and on the coordinated development of science and technology, society and economy. Apart from the several problems mentioned beforehand, there are many problems we must study at present. A district or a department in particular must firmly grasp industrial superiority, key projects and their economic returns, explore correct ways of applying science and technology to promote development, really act as "brain trust" and "staff officer" to leading members at various levels and make contributions to scientific policymaking.

CSO: 4008/144

APPLIED SCIENCES

INFORMATION RESEARCH INSTITUTES PROVIDE NEEDED ASSISTANCE

Aid in Energy Conservation

Beijing GUANGMING RIBAO in Chinese 30 Jan 82 p 2

[Article: "Xiangfan City Scientific Information Research Institute Combines Efforts With Economic Buildup To Launch Information Work"]

[Text] The Xiangfan City Scientific and Technical Information Research Institute in Hubei Province is a new institute established in 1975. For several years, it has closely combined its efforts with the needs of development in production, carried out research and investigation in a big way, quickly launched information gathering work and achieved notable economic results.

In investigating and researching information, the institute discovered that conservation of energy and conservation of raw materials are the most common problems in the city's industrial production. Therefore, it concentrated on finding and introducing advanced technology in these aspects and developed an information service. For example, before 1977, many factories throughout the city had a power utilization rate of between 0.6 and 0.7, and some even had a lower rate. These factories were fined because their power utilization rate was lower than the national standard of 0.8. After the information institute learned of this situation, it quickly searched for information on "power factor compensation devices" and tested the devices at the city's lumber company. The power utilization rate rapidly increased from 0.6 to 0.95, and the company changed from being fined to being rewarded. After the successful completion of the tests, a report was immediately presented to the city leadership and it was suggested that such devices be popularized throughout the city. For over 4 years, the whole city's power factor has been improved, thus reducing the fine by 746,000 yuan.

Information regarding product competition is urgently needed in order to provide information and technology to develop new products that suit the market needs. For several years, the Xiangfan City Information Institute conducted investigations and studied special topics to develop new products and made relatively large contributions. For example, in 1978 the institute reviewed domestic and foreign literature and discovered that porcelain

fiber is a new type of refractory material that has a bright future for development, and Xiangfan City also has the raw materials for producing this product--pyromorphous gems. Thus, members of the institute went to other places to learn the technology and techniques to produce porcelain fibers, and after investigating the market for the product, they presented a report entitled "The Possibility of Developing and Producing Porcelain Fiber Products in Our City" to the city science committee. The report analyzed the source of raw materials, production technology and conditions, cost, profit, investment estimates, and market needs. The city science committee approved their opinions and included this subject in the scientific research projects for 1979. The trial production was successful, and this blank in the south-central region was filled. The city committee decided to establish a second refractories plant to produce this product. This new energy-conserving material has been popularized throughout the province.

Knowledge of Document Searching

Beijing GUANGMING RIBAO in Chinese 30 Jan 82 p 2

[Article: "Nantong City Scientific and Technical Information Research Institute Strengthens Counselling Service, Improves Rate of Utilization of Information"]

[Text] The method of the Nantong City Scientific and Technical Information Research Institute of Jiangsu Province has provided three types of experience in how to develop the function of scientific and technical information.

First, it actively developed information search and retrieval for others along with counselling services. During the past 2 years, the institute has surveyed the basic situation of more than 300 factories in the city. Besides regularly providing general information and data to the factories, it has also developed services aimed at specific subjects. For example, the quality of the products produced by the city's daily commodities chemical plant was affected because of a poor antiseptic used in the production of Pearl face cream. For this purpose the scientific and technical information institute wrote letters to plants in other localities seeking information, looked into the institute's own information, found the prescription and information, and provided the information to that plant as reference for producing new products.

Second, it strengthened the transmission of secondary information. To enable the basic level units to be aware in time of the information and data gathered by the institute, it scanned the information received during the day and organized the information each day and every month. During the month, it compiled a "table of contents of newly received data." Within a week, seven or eight units came forward to seek related information based on the table of contents.

Third, it popularized knowledge about document searching. During the survey of basic level units, the Nantong City Scientific and Technical Information Institute discovered that less than 0.3 percent of the people among the whole city's scientific and technical personnel had any knowledge about searching for foreign and domestic documents. Therefore, it conducted several classes in document search techniques so that concerned scientific and technical personnel were able to grasp the basic method of searching for information.

Sunflower, Coal Mud Problems

Beijing GUANGMING RIBAO in Chinese 30 Jan 82 p 2

[Article: "Fuxin City Scientific and Technical Information Research Institute Serves as a Good Adviser for the Leadership"]

[Text] Fuxin city in Liaoning Province is our nation's major base for producing sunflowers. The sunflower planting area constitutes one-fourth the national total. The leading comrades of the city instructed the Fuxin Scientific and Technical Information Institute to contribute to the development of sunflower production. Afterward, the institute organized personnel to look for related information, held a discussion meeting on sunflower production techniques, and systematically introduced seven technical measures in sunflower production in the institute's FUXIN SCIENCE AND TECHNOLOGY NEWS. At the same time, it also sent information gatherers to Jilin province to investigate sunflower insect pests and made proposals to prevent and control the orobanche indica (?) disease, which causes serious damage. After approval by the leading comrades of the city committee, the prevention and control techniques were quickly popularized throughout the city. The institute also organized the city's network of spare-time foreign language translators to translate related information totaling over 300,000 words and published two books entitled "Translations on the Sunflower." The books were distributed to the agricultural cadres and technical personnel of the city, county and commune. In 1980, Fuxin area realized a bumper sunflower harvest. The yield reached 120 million jin.

Fuxin is also one of our nation's coal-producing bases. A large amount of coal mud remaining after coal selection has caused serious pollution of the urban environment. The city committee decided to solve and treat the problem of coal mud. Based on the situation, the Fuxin City Scientific and Technical Information Research Institute organized concerned personnel to make an inspection tour of Hebei, Shanxi and Shaanxi Provinces, read through a massive amount of data, and presented a preliminary investigative report on the recovery and utilization of coal mud at home and abroad. At the same time, it proposed suggestions on how to develop the utilization of coal mud in the city. The city level information network of the northeastern region wanted to solve the problem of comprehensive utilization of coal mud in the northeastern cities and commissioned that institute to conduct a survey for comprehensive utilization of coal mud in the six cities of Fuxin, Hegang, Shuangyashan, Jixi, Fushun, and Benxi. After completing

the task, it also held a discussion meeting of the experts of the six regions and took notes on the discussion meeting. The information and data drew the attention of the city's leadership.

Foreign-Language Translation Network

Beijing GUANGMING RIBAO in Chinese 30 Jan 82 p 2

[Article: "Zigong City Scientific and Technical Information Research Institute Organizes a Spare-Time Foreign-Language Translation Network"]

[Text] The Zigong City Scientific Research Department in Sichuan as well as large enterprises and many units lacked translation capabilities. To solve the difficulty in translation, in 1978 the Zigong City Scientific and Technical Information Research Institute organized a citywide spare-time foreign-language translation service network. Now, there is a team of 25 people who can translate five languages--English, French, German, Russian, and Japanese--and the service has established "general regulations of the foreign-language service network" and related systems. For more than 2 years, the team conducted four Japanese and English learning classes for scientific and technical personnel and held more than 20 operations lectures and exchange of experience meetings. The team translated and edited over 600,000 words of information for the city's scientific research, production and foreign trade units, and printed over 400 pages of English text.

In service work, this translation network has been able to do all the work requested and has finished the tasks quickly. The translations are reliable, the fees are inexpensive, and the work has been welcomed by the users. For example, in 1979 the city's chemical engineering research institute test-produced a laser tube material and urgently needed foreign-language information for reference. This institute did not have sufficient translation capabilities and it could not find outside help. The spare-time translation network learned of the situation and actively helped out by translating over 60,000 words of information in time. Last April, Zigong's Longjing Switch Factory was invited by the provincial business department to participate in the Hangzhou electromechanical products exhibition. Prior to the exhibition, a products explanation brochure in English and Chinese had to be sent to the exhibition. The spare-time translation network rushed translations of brochures on five products for the plant, thus enabling it to participate in the exhibition on time and to conclude more than \$300,000 worth of export trade.

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CSO: 4008/96

CHINESE CHARACTER INFORMATION MANAGEMENT SYSTEM DEVELOPED

Fuzhou FUJIAN RIBAO in Chinese 3 Nov 81 p 1

[Article by reporter Tang Wenyuan [0781 2429 0337]: "Welcome News About Using the Microcomputer To Process Chinese Character Information; Multiple User Chinese Character Information Processing System Is Successfully Developed"]

[Text] The Fujian Provincial Electronics Technology Research Institute and Beijing University have jointly developed a multi-user Chinese character information processing system successfully. It was exhibited at the National Computer Exhibition in Beijing and received high praise from concerned departments of the central authority. The successful development of this system will enable the widely used microcomputer systems in our nation to operate with information in Chinese characters. It is another new achievement in our nation's electronic technology. A prototype of the system was shipped back to Fuzhou on 27 October to prepare for small-batch trial production.

The multi-user Chinese character information processing system is a micro-computer system that processes information in Chinese characters. It consists of a DJS040 microcomputer, three Chinese character display terminals, one Chinese character printer, and four flexible disc drives. It can store 8,000 Chinese characters. The form of the characters is beautiful and clear. The system can be used for text compilation and page composition in journalism, publishing and printing, business management, production control, statistical reporting in industry and mining, operations processing for postal and telecommunications, filing and searching information, data and documents, military command, job processing in government agencies and offices, and it can also serve as a terminal for other large computers.

This Chinese character information processing system is small in size, its function is complete and its operation is convenient. Working at the Chinese character display terminal requires only the use of a detector pen. The pen is maneuvered on a touch-sensitive keyboard to delete or insert text at will. Corrections moving lines of text, combining sentences and such editing and composing functions are displayed on the fluorescent screen immediately. After composing the text, it can be stored in the mainframe memory and can be accessed by command any time. If the text is to be printed, the operator only has to press the key to operate the printer. This Chinese character information processing system is being further perfected.

FEATURES, APPLICATIONS OF PLASMA ENGINE DESCRIBED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 3,
Mar 82 pp 12-13

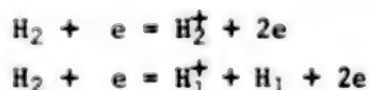
[Article by Song Yuyang [1345 5940 7122]]

[Text] Ever since the successful launch of the first artificial earth satellite in October 1957, a variety of satellites and spacecraft have been placed into the sky one after another. Along with the advancement in space technology, a number of new propulsion devices have appeared. The plasma engine is one of these devices.

What the Plasma Engine Is

Before we describe what a plasma engine is, let us first discuss the nature of plasma.

Plasma is an ionized gas. When gas molecules are bombarded by electrons, they become ionized. If the electrons are lost, the molecules become positive ions. For example,



Therefore, a plasma is a mixture of ions, electrons, and neutral particles; on a macroscopic level they are electrically neutral.

In a plasma engine used in space travel, the plasma is generally produced by bases or vaporized di-electric materials.

In order to ionize a working medium to produce plasma, the medium must be heated to a temperature where the kinetic energy of the atomic thermal motion becomes greater than the ionization energy. For hydrogen or deuterium, the required temperature is 160,000°K. Most existing materials cannot tolerate such high temperatures. But in a plasma, the actual temperature is much lower because the electrons and ions are in a state of equilibrium. To ensure reliable engine operation, a magnetic field is used to constrain the plasma (as shown in Fig. 1) so that the high-temperature plasma will not come in contact with the chamber wall.

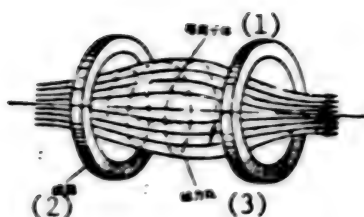


Fig. 1. Constraining Plasma Using Magnetic Field

Key:

- (1) plasma
- (2) coils
- (3) magnetic lines

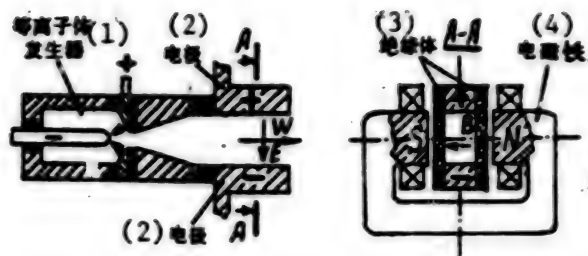


Fig. 2. Diagram Illustrating the Operation of a Plasma Engine

Key:

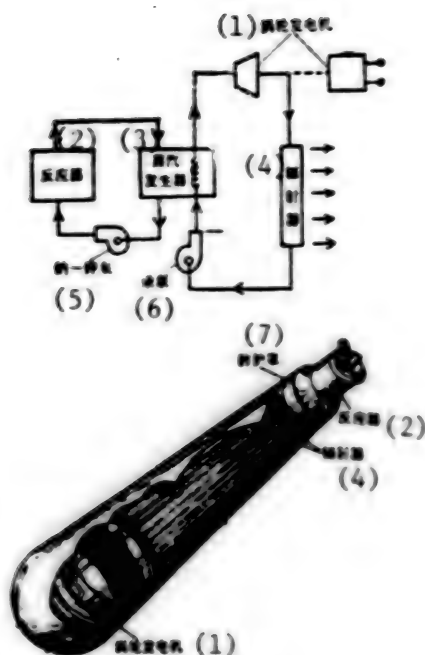
- (1) plasma generator
- (2) electrodes
- (3) insulator
- (4) electromagnet

Fig. 2 is a diagram illustrating the operation of a plasma engine. It has two electrodes--anode and cathode; the space between the electrodes and the side walls provides a passageway for the plasma. This passageway is perpendicular to the electric field E on the one hand, and penetrates the magnetic current generated by the magnetic inductance B on the other. From the plasma generator the plasma enters the accelerator. Inside the accelerator current flows from the anode through the plasma to the cathode. Under the action of both the electric and magnetic fields the propelled speed plasma jet leaving the accelerator produces a thrust in the opposite direction. Since in this engine the conversion of electric energy to kinetic energy is accomplished by a plasma medium, it is called a plasma engine.

Power Unit

A plasma propulsion system has two major components: the thrust-producing plasma engine, and the power unit, which provides electric energy to the engine as well as other segments of the satellite or spacecraft. Currently, power units with 5 to 50 kw output have been built for space travel. There are two types of power units for plasma engine: one is nuclear power unit; the other is solar power unit.

Fig. 3 shows the SNAP-2 power unit. The top part of Fig. 3 is a simple operational diagram; the bottom part shows the exterior of the power unit. This is a dual-circuit system in which the first circuit uses sodium-potassium alloy (which has a melting point of -11°C , and a boiling point of 784°C under a pressure of 10 P_a) as the heat transfer medium, and the second circuit uses mercury as the working medium. The sodium-potassium alloy emerges from the reactor at a temperature of 650°C , and enters the vapor generator where mercury is heated to a temperature above its boiling point of 357°C . The vaporized mercury (at a pressure of 700 KPa and temperature of 620°C) drives the turbine which rotates at a speed of 40,000 rpm, and produces 3,000 watts of power. The mercury vapor exhaust from the turbine enters the radiator where it is cooled and condensed into liquid (at a pressure of 42 KPa and a temperature of 315°C), and then is returned to the vapor generator through the mercury pump. The entire power unit without the shield weighs 345 kg.



Key:

- (1) turbo-generator
- (2) Reactor
- (3) vapor generator
- (4) radiator
- (5) sodium-potassium pump
- (6) mercury pump
- (7) protective shield

Fig. 3. The SNAP-2 Power Unit and Its Operational Diagram

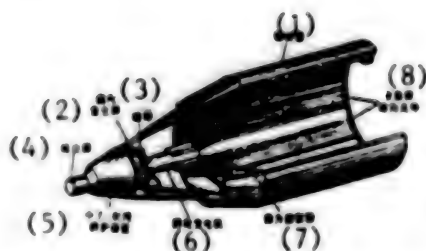
Because nuclear fuel has a problem with critical mass, small plasma engines usually use solar power units.

On a manned spacecraft, maintaining a certain distance between the nuclear power unit and the astronaut cabin to ensure safety is required. Fig. 4 shows the typical location of a power unit in a spacecraft. This is a 25-kw power unit which weighs 3,600 kg without the shield; the shield weighs 2,000 kg, and the distance between the power unit and the astronaut cabin is 15 m. Fig. 5 shows another type of power unit.



- Key: (1) power unit
(2) cabin section

Fig. 4. Typical Location of SNAP-2 Power Unit in a Spacecraft



- Key: (1) radiator (5) protective shield against neutrons and gamma-rays
(2) vapor generator
(3) magnetic rod
(4) reactor (6) turbo-generator
(7) thrust control device
(8) collector elements

Fig. 5. Structural Diagram of a Power Unit

Special Features and Applications

The plasma engine has the following special features:

1. large specific impulse ($10^2 - 10^4$ seconds)
2. low thrust ($10^{-3} - 10$ newtons)
3. long operating life
4. capable of multiple engine starts
5. low efficiency
6. thrust to weight ratio less than 1

The last feature implies that a plasma engine must rely on other propulsion devices (such as solid or liquid rocket engines) to inject a spacecraft into orbit before starting to operate. Since this type of engine generates relatively low thrust, it is primarily used for position keeping, attitude control, and orbit correction for satellites, spacecraft, and space stations.

As a low-thrust, long duration propulsion device, the plasma engine has some outstanding characteristics. For example, a chemical-fuel rocket engine with a thrust of 0.01 kg and an operating life of 1 year requires 1,240 kg of high energy fuel with a specific impulse of 250 seconds; therefore, the total engine weight including engine housing and accessories will reach several tons. Under the same conditions, a plasma engine would be much lighter and more reliable.

On the basis of engine operation, plasma engines can be classified into two types: the continuous operation engine and pulsed operation engine. The former does not require a condenser and is simpler in structure. The Soviet satellite "Meteor" launched in 1971 had two continuous operation plasma engines each with a thrust of 0.02 newtons. In February 1972, with the aid of these engines, the satellite was transferred into a synchronous orbit.

At present, the abrasion type pulsed plasma engine is the most commonly used in space travel. This type of engine uses volatile di-electric materials such as poly-tetrachlorine ethylene as the working medium. When the condenser discharges, this material is vaporized under heat and ionized at the same time. Under the action of electric and magnetic fields, the ionized gas exits from the engine at high velocity, thereby generating thrust.

In December 1964, the Soviet Union launched the Zond-w monitoring station (5.37 million km from earth) toward Mars, which for the first time used six abrasion type pulsed plasma engines for direction control. The engines were operated by command signals to maintain the station's position relative to the Sun in a given time period.

In 1968, the United States launched the "Lincoln Experimental Satellite No 6," which had four abrasion type pulsed plasma engines built by "Fairchild" Corporation to maintain the longitudinal position of the satellite. Each engine operates on a 6-sec pulse cycle; when all four engines operate in series, the net pulse interval is 1.5 seconds. It is estimated that each engine can discharge 12×10^6 times; each discharge produces a thrust of

2 mg; and the operating life in space is over 2 years. Recently, this country successfully flight tested two pulsed type plasma engines. This marked a new phase of China's research and development efforts in electric rocket engines, and placed China as the fourth nation in the world to flight test electric rocket engines in space.

3012

CSO: 4008/124

SUCCESSFUL FLIGHT TEST OF Y-10 IS GREAT SOURCE OF PRIDE

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 3, Mar 82
pp 2-3

[Article by Xie Chu [6200 4342]]

[Text] The exterior of this airplane is just beautiful. On the 43-m silver-white fuselage are painted three blue and red stripes; four large turbofan engines are suspended underneath the 42-m wing span; the vertical tail is 13m in height, and has a five-star red flag painted on it, which looks particularly impressive under the sunlight. This is the first large jet passenger plane designed and built by this country--the "Y-10."

The airplane was parked at one of Beijing's airports. Members of the flight test group led us up the boarding ladder and into the rear passenger cabin. The number of seats in the cabin can be varied according to specific needs. For long-range international flights, the cabin can be divided into first-class and tourist sections with a total of 124 seats; for domestic flights, it can have a single section with 149 seats; for short-range economic flights, as many as 178 seats can be accommodated. As we passed through the rear cabin toward the front of the airplane, we noticed the comfortable seats each equipped with air-conditioning vents, reading lights, luggage compartments, and life jackets. According to the comrade engineers, the Y-10 is designed on the basis of domestic civil aviation requirements, but it also meets the requirements of international civil aviation organizations.

Inside the cockpit at the front of the airplane, there are five seats: the two front seats are for the captain (pilot) and the co-pilot, the middle seat is for the engineer, and the two rear seats are for the navigator and the radio operator. The front and side walls and the ceiling are covered with flight instruments. When I was invited to sit in the pilot's seat and allowed to experience the feeling of operating such a complex airplane through the wide view window, I could not help remembering 7 years ago when I was touring the plant at Shanghai where the Y-10 was being developed. At that time, the design and research work of the Y-10 had just begun, and I was in the cockpit of a wooden mock-up. The mock-up was the same size as the real airplane, and was primarily used by the designers to arrange various components inside the airplane. It is amazing that in just a few years the blueprint and mock-up has become a reality. One can imagine how much sweat and labor had been contributed by the aeronautical engineers, the party officials, and the technicians.

In a conversation with the flight test group leader, I could sense the pride he had in flight testing the first Chinese-designed large passenger airplane. He was more than happy to answer all my questions.

"During the flight from Shanghai on 8 December, what was your flight speed? What was the total flight time?" I asked.

"850 km per hour, on Mach 0.79 (i.e., 0.79 times the speed of sound). The total flight time was 1 hour 48 minutes. However, since advanced wing design is used on this airplane, the maximum cruising speed can reach 900 km per hour," he replied.

"Were there any passengers? What was the take-off weight?"

"There were several tens of passengers, the take-off weight was 87 tons--not fully loaded. The airplane was designed to have a take-off weight of over 100 tons."

"How did it feel during the flight?"

"Very smooth. From Shanghai to Beijing, we cruised at an altitude of 9,000 m. The ambient temperature was more than 30°C below zero, but the temperature inside the cabin was maintained at 18°C. On our return trip we will fly at an altitude of 10,000 meters."

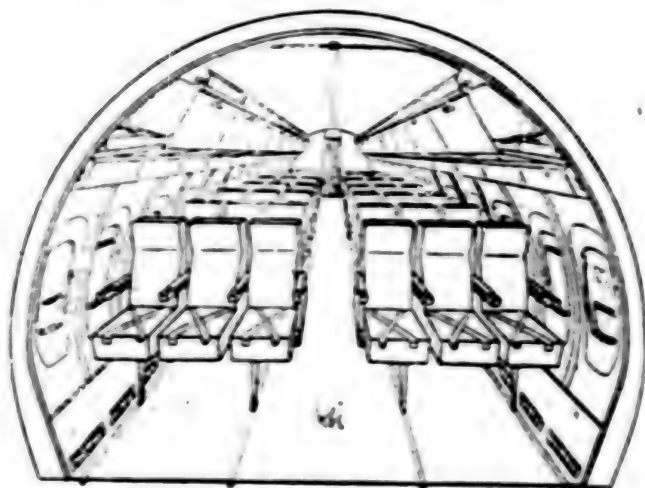
"Have you ever flown other airplanes before? Do you have any comments to make?"

"I was transferred to the Y-10 flight program 2 years ago. Prior to that I had several thousand hours of flying time, primarily on Boeing airplanes. I am really pleased to be able to fly our own airplanes."

The Y-10 airplane was first flown in Shanghai on 26 September 1980. During the past year many flight tests were performed. The airplane used in the flight tests was the No 2 prototype; the No 1 prototype had been used in static destruction tests. Up to the present, the overall flight test plan has not been completed. This round trip flight between Shanghai and Beijing was an important part of the plan. But in order to perfect the design of an airplane, particularly the design of a large passenger jet such as the Y-10, a large amount of additional work is required.

In this country there has been very little experience in designing passenger airplanes. Therefore, the development and flight test of the Y-10 will provide valuable experience in the future. After the maiden flight of Y-10 2 years ago, it received a number of reviews from foreign journals. The British weekly FLIGHT INTERNATIONAL reported: "China's main objective in developing the Y-10 is not only to produce a few passenger airplanes, but also to develop its technology in aeronautics." REUTERS commented: "According to aviation experts, developing a large passenger plane such as the Y-10 will provide valuable experience for the Chinese aeronautical engineers and scientists. Once they master such advanced technologies, China will no longer be referred to as a developing country by others."

The car started moving away. Looking back at the Y-10 parked on the open field, we all shared the common thought: the intelligence and capability of Chinese scientists and engineers are certainly not inferior to that of their foreign counterparts. We hoped that in the future there will be more and better Chinese airplanes carrying cargo and passengers across the sky of China!



Note: The inside dimensions of the passenger cabin are as follows: 30.4 m long, 3.48 m wide, 2.2 m high, and approximately 200 cubic meters in volume. Each row can accommodate six seats, with a walkway in the middle. The air-conditioning system provides a residual pressure of 0.6 atmosphere, and a controllable temperature range between 16°C and 30°C.

Fig. 1 Cross Section of the Passenger Cabin of the Y-10



Figure 2. The three Views and Exterior Dimensions of the Y-10 Passenger Airplane

Key: (1) 1 unit: meter

3012
CSO: 4008/124

APPLIED SCIENCES

BRIEFS

COLD LIGHT SOURCE BLUEPRINT DEVELOPER--The nation's first large heavy nitrogen, ammonia-free cold light source blueprint developer has been successfully developed. Up to now, the blueprint developers manufactured domestically have generally used high-voltage mercury lamps as the light source for exposure. They waste electricity, the temperature of the working environment rises, and the blueprint paper is sometimes blurred by high temperature. This affects the use and storage of blueprints. Workers have to operate under high temperatures and the work conditions are very harsh. For this reason, the Beijing Geological Instruments Plant, the Beijing Light Bulb Plant, the Beijing Blueprint Developing Plant and the Beijing Nonferrous Metals Research Institute with the support of the Beijing City Technology Exchange Station finally developed a new copying technique using a heavy nitrogen, ammonia-free cold light source successfully. This new blueprint developer produced by the Beijing Geological Instruments Plant conserves 90 percent of the electricity compared to the hot light source blueprint developer. It also eliminates environmental pollution and improves the working conditions. The cost of the whole machine is reduced by 20 percent. This achievement has filled a blank in our nation. [Text] [Beijing BEIJING RIBAO in Chinese 14 Jan 82 p 2] 9296

CSO: 4008/96

LIFE SCIENCES

GUANGZHOU TO BUILD CHINA'S FIRST EYE BANK

Shanghai WEN HUI BAO in Chinese 16 Mar 82 p 1

[Text] The preparations for the first eye bank in China at the Ophthalmological Hospital of Zhongshan college of medicine in Guangzhou are complete, creating conditions for the blind to undergo sight-restoring surgery. In order to support the construction of the eye bank, at the January session of the national conference on the prevention and cure of blindness, more than 100 eye specialists signed a proposal to donate their eyes after death. Afterwards, more than 40 doctors, teachers, cadres, and workers responded to the proposal, among them were Guangzhou's vice-mayors Luo Peiyuan, Chen Anliang and others.

This eye bank, under the direction of Professor Du Nianzu a cornea transplant specialist, has advanced equipment, including equipment to store the live cornea for from 4 to 5 days to over a year. For the past few years, there have been about 200 successful transplant operations every year, accounting for more than one-third of the national total, with a 90 percent success rate, some attaining international levels and receiving the attention of ophthalmology departments from around the world. Qian Zhangzhu, an English national of Chinese descent who was blind in the left eye due to corneal disease, 4 years ago could not be cured abroad, regained 0.2 vision in his left eye after an operation at this hospital.

According to the estimates of medical specialists, China now has approximately 2 million people who are blind due to corneal disease, and most of them could regain sight after an eye transplant. However, due to the influence of old ideas those willing to donate their eyes after death are few. For this reason, the specialists have recommended that in the course of constructing a socialist spiritual civilization, the donation of eyes after death to benefit the blind be vigorously advocated.

CSO: 4008/137

LIFE SCIENCES

SHANGHAI COLLEGE ESTABLISHES TWO STRAINS OF CANCER CELLS WHICH CAN BE CONTINUOUSLY TRANSMITTED

Shanghai WEN HUI BAO in Chinese 19 Mar 82 p 1

[Text] The pathology, physiology, and biophysics faculties of the First College of Medicine at Shanghai basic medicine department successfully established two strains which can be continuously transmitted--one a mouse viral lymphocytic leukemia and the other an abdominal fluid ascites or hydroperitoneal tumor model. Until now, the former had been transmitted for 87 generations, and the latter for 344 generations, and the growth characteristics are basically stable. This scientific achievement recently received the approval of the Ministry of Public Health at the ministerial level.

Tumors are a common disease and seriously threaten people's health. Through clinical and experimental evidence, we know that the carcinomas, sarcomas, and leukemias found in many animals such as frogs, chickens, rats, cats, cattle, monkeys, and baboons can be caused by virus. Research into the causes of leukemia viral disease is one breakthrough for discovering the causes of tumors, and the mouse leukemia model is a useful tool for investigating the causes of viral disease. In 1965, this medical college established a strain of mouse viral lymphocytic leukemia which can be continuously transmitted from generation to generation, which for the past 17 years, has been transmitted for 87 generations. In 1971, again successfully established a mouse lymphocytic hydroperitoneal tumor strain, which has already been transmitted for 344 generations, and has been selected by many units in China as an experimental model for scientific research.

By means of the detailed investigation of the biological characteristics of mouse leukemia and hydroperitoneal tumor, and the isolation of the viruses and their preliminary purification, we have proved these two tumor strains and the viruses isolated from them both have a direct relationship to studies of the cause and incidence of these diseases.

CSO: 4008/139

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9717

CSO: 4008/138

AUTHOR: FAN Tianwei [2868 1131 5588]

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TITLE: "A Method of Estimating the Derivatives Applied to Curve Fitting"

SOURCE: Beijing SHUZHJ JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 1-11

TEXT OF ENGLISH ABSTRACT: The piecewise cubic Hermite interpolation is effectively applied to curve fitting, especially to computer curve output. The derivatives required in the interpolation are often obtained from the given data points by estimation. Akima proposed a geometric condition to estimate the derivatives of the function defined by these points, but its accuracy is frequently unsatisfactory. This paper provides an algorithm for estimating the derivatives based on a local procedure of cubic polynomial. Generally, the error of this algorithm and Akima's, except for two points closed to the ends, is in a ratio of about one to several hundred. When compared with Akima's procedure, the number of operations of this algorithm is larger, but in a special case of uniform mesh for single-valued functions there is little difference between them.

AUTHOR: FENG Baipai [7458 0130 1014]

ORG: Shanghai Institute of Computing Techniques

TITLE: "The Gear Program for Solving Initial Value Problems in General or Stiff Ordinary Differential Equations"

SOURCE: Beijing SHUZHJ JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 12-23

TEXT OF ENGLISH ABSTRACT: In this paper, a procedure to realize the Gear method is given. It can be used to solve the initial value problems in general or stiff O.D.E.S. with order 12 or 6 respectively. It may start and select step size automatically and make the corresponding change of order. The Jacobian matrix of right-hand side functions of the equations may be given by users directly or by procedure automatically. Moreover, in this procedure, the coefficients of the formula are stored in a special form so that the program is shorter and the storage needed is less.

AUTHOR: PEI Lucheng [5952 7773 2052]

ORG: Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "Application of Adjoint Monte Carlo Method to Shielding Calculation"

SOURCE: Beijing SHUZHJ JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 24-30

TEXT OF ENGLISH ABSTRACT: There exist some difficulties or problems if the general Monte Carlo method is used for the shielding calculation. This paper intends to give two methods, namely, adjoint statistical estimation method and adjoint exponential transformation method, with which these problems can be solved successfully. The practical calculation shows that the efficiency of these two methods can be raised over one to six times as compared with general statistical estimation method and general exponential transformation method.

AUTHOR: WEI Ziluan [7614 4793 7019]

ORG: Computing Center, Chinese Academy of Sciences

TITLE: "A Modified Algorithm for the Generalized Upper Bounding Problem"

SOURCE: Beijing SHUZHJ JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 31-38

TEXT OF ENGLISH ABSTRACT: This paper presents a modified algorithm for generalized upper bounding problem (GUB). It consists of two main parts. In the first part, the formulas for computing the simplex multipliers and the reduced costs are derived. In the second part, the dynamic block pivotal method, presented by Kahn, is used to solve GUB problems. Finally, the computing steps of the algorithm are described.

AUTHOR: WANG Zeyi [3769 3419 3015]
SUN Jiaguang [1327 1367 1684]

ORG: Both of Qinghua University

TITLE: "A Solution of Linear Algebraic Equations for Orthogonal Elimination and Non-orthogonal Elimination of Mixed Mold"

SOURCE: Beijing SHUZHJ JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 39-47

TEXT OF ENGLISH ABSTRACT: A new triangular elimination approach is proposed in this paper. The orthogonal mold elimination (fast Givens transformation) and non-orthogonal mold elimination (Gauss elimination) can be compatibly used, so that the amount of multiplication and division is between Gauss elimination and Householder transformation. This paper proposes the method of reducing extremely the amount of the orthogonal mold elimination so that the total operation is almost equal to the Gauss approach. We prove that the elimination procedure of mixed mold can be realized by using the method of two precedently orderings. The numerical stability in the third section is analyzed. At the end of this paper the results of tens of examples tested are given.

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BAO Guangde [7637 1684 1795]
YAO Yunfu [1202 0061 3940]

ORG: SHAO of the Computing Center, Chinese Academy of Sciences; BAO of the Fourth Ministry of Machine Building; YAO of the Institute of Electronics, Chinese Academy of Sciences

TITLE: "Computation of 2-D Magnetostatic Fields by Finite Difference Method"

SOURCE: Beijing SHUZHJ JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 48-56

TEXT OF ENGLISH ABSTRACT: In this paper, the physical modeling for the permanent magnets and the finite difference method is described. The system of finite difference equations is solved by the method of relaxations. Numerical experiments show that the computed results are satisfactory.

AUTHOR: WANG Qizhong [3769 0796 1813]

ORG: Xi'an Institute for Optics and Precision Mechanics, Chinese Academy of Sciences

TITLE: "An Applied Program Packet for Optical Design"

SOURCE: Beijing SHUZHJ JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 57-62

TEXT OF ENGLISH ABSTRACT: This paper describes a design idea of an applied program packet for optical design, the structure of the leading program, the calling method and the function of some main programs within the program packet.

AUTHOR: WU Huamo [6762 5478 6206]

ORG: Computing Center, Chinese Academy of Sciences

TITLE: "Elementary Proof of the Schur-Cohn-Miller Theorem"

SOURCE: Beijing SHUZHJ JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese No 1, 1982 pp 63-64

TEXT OF ENGLISH ABSTRACT: This note provides a practical modification of the Schur-Cohn-Miller theorem about the location of the roots of polynomials of the second order with complex coefficients. An elementary proof of this theorem is given.

9717

CSO: 4009/285

AUTHOR: WU Zhishan [0702 5267 1472]
SUN Tianzong [1327 1131 4912]
LIU Yunliang [0491 0336 5328]

ORG: None

TITLE: "The Processing and Geological Interpreting of Digital Data From Landsat"

SOURCE: Changchun CHANGCHUN DIZHI XUEYUAN XUEBAO [JOURNAL OF CHANGCHUN GEOLOGICAL INSTITUTE] in Chinese No 4, 82 pp 62-69

ABSTRACT: The authors used the "101 digital image processing system" to carry out many types of processing on 2 satellite tapes. The 101 system is produced by the International Image Systems (I²S) of the Stanford Technology Corporation (STC) of the USA. It consists of special hardware and software which can process the Common Computer Tape (CCT) of the multi-spectral scanner (MSS) of the American Land Satellite (LANDSAT). The hardware consists of the HP3000 CPU, the M70 image processor, the C4500 digital scanner, and assorted accessories. The software includes many special subroutines. The article describes in some detail the terrain covered by the tapes, including the area around Chengde and the Great Wall north of Beijing. The image processing is described as consisting of 3 main steps: (1) Image recovery; (2) Image enhancement; (3) Image analysis. The results of image enhancement vary a great deal, with different images. Many methods of image enhancement are discussed. The first of these is reflectance expansion, which

[continuation of CHANGCHUN DIZHI XUEYUAN XUEBAO No 4, 1982 pp 62-69]

involves the emphasis of the statistical distribution of luminosity. According to the features we wish to enhance there are various transfer functions which allow each image element's original gray level (x) to be transformed into a gray level (y). Examples are given. Another method is color enhancement. This is important because the human eye has a much greater power to discriminate colors than gray levels. The method of proportional values is discussed, as is the method of wave filtering. Several matrix transformations which illustrate filtering principles are presented. The 5th method of image enhancement discussed is the KL method, also called the analysis of major components and is based on the statistical nature of the image. Several methods of image classification are also discussed, including cluster analysis which is carried out by the CLUSTER subroutine, and minimum distance analysis which is carried out by the MINDIST subroutine. The article concludes that the 101 system is quite advanced and meets many needs, and the enhancement methods are effective.

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ORG: None

TITLE: "Some Improvements in the DSJ-18 Computer"

SOURCE: Changchun CHANGCHUN DIZHI XUEYUAN XUEBAO [JOURNAL OF CHANGCHUN GEOLOGICAL INSTITUTE] in Chinese No 4, 82 pp 113-118

ABSTRACT: The DSJ-18 (also called the 6912) Computer is a Chinese made medium scale, general purpose digital computer. There are currently something over ten of them in China. It is useful for all kinds of scientific computing involving large amounts of data. In the course of using and maintaining the machine a number of insufficiencies were discovered and corrective action was taken. The paper describes these problems as involving 3 areas: the interrupt structure, the internal memory timing, and the print routine of the diagnostic program. There was a problem in the operational unit in that electrical power could not be randomly increased and decreased. It often could be increased but not decreased. This had an especially big influence on tape drives. This was one of a number of problems that were identified as relating to the interrupt structure. A fairly complex procedure for fixing the interrupt problems is described in great detail. A great deal of attention is paid to the effort to speed up the computer by reducing the internal storage cycle time. The computer has the capability of executing instructions at an effective rate of 120,000 per second. This derives

[continuation of CHANGCHUN DIZHI XUEYUAN XUEBAO No 4, 82 pp 113-118]

from a cycle time of 480 nanoseconds and the fact that the average instruction (with proper weights given for the most frequently used instructions) takes 17.5 cycles. The main factor influencing the speed of computation was found to be not on the control unit but in memory. It was discovered that the basic operational cycle could be speeded up to 400 nanoseconds, increasing the effective rate of computation to 140,000 operations per second. The article discusses the problem of the print routine of the diagnostic program. The problem was considered to derive from the fact that the diagnostic program was not sufficiently complete and required excess manual intervention. The software and hardware improvements which fixed the problem are described in detail.

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CSO: 4009/264

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TITLE: "A High-Level Language Oriented Multi-Processor Architecture"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT]
in Chinese No 2, Feb 82 pp 1-6

ABSTRACT: This article proposes a multi-processor system which directly executes high level language systems. It points out the disadvantages of the traditional von Neumann machine with its single processor and common storage of data and instructions. Operating systems were developed which made these machines much more effective but software complexity obstructed progress and multi-layers of software hid the complexity of the hardware from the user. Layers of program changes caused the machine language program to lose correspondence with the high order language. The various difficulties in achieving optimum performance with traditional computers are traced to 2 sources: The first is the contradiction between the changes in the external characteristics of the computer and the internal system structure; the second is the lack of correspondence between the external language and the internal system. The execution of any high level program includes the language processing, the functional operation, and the control of the operational program.

[continuation of JISUANJI YANJIU YU FAZHAN No 2, 1982 pp 1-6]

The system structure proposed here is designed with a modular structure based on these characteristics of the high order language. This structure includes (1) the LP [language processor] including the local memory, simple arithmetic logic unit, and the console, which can connect the LP with the B-Bus or the B-Bus with the PCP; (2) The PCP [program control processor] including the LOCM [local memory] and CU [control unit] which includes an 8 or 16-bit arithmetic logic process; (3) ALP [arithmetic logic processor] including the control unit, ALU and various multiplexers; (4) MM₁ [data memory] which is independent of the PCP; (5) PM [program memory] using external storage; (6) IOP [the input-output processor]; (7) SP [special dispatch]; and (8) System traffic, which the A-Bus ties together PCP₁ with M₁, and the B-Bus ties together LP₁ and PCP₁, and the C-Bus ties together¹ the various PCP's and IOP's. This structure overcomes many of the shortcomings of traditional computers and allows a high performance to be achieved at a much lower cost, and raises the utilization of resources. Every executive program has its own PCP, resulting in an independent control stream, thus avoiding the management problems of traditional operating systems.

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TITLE: "A Special Purpose Signal Computer Architecture"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT]
in Chinese No 2, Feb 82 pp 7-12

ABSTRACT: Although the microcomputer is widely used, its system architecture limits its application in digital signal processing, especially real-time applications. However, recent advances in semi-conductor technology provide the basis for the resolution of this problem. For example, the Intel 2920 is a single board ANALOG microcomputer suitable for real-time digital filtering. The American Microsystem S 2811 and the NEC D 7720 use multiplier arrays to increase processing speed. There is also the CORDIC microcomputer announced in 1980 and developed by the US Navy. It is used for trigonometric and hyperbolic functions, and can perform high speed coordinate transformations. The CORDIC arithmetic involves a mathematical technique which allows a wide range of transcendental functions to be implemented by simple set of iterative equations. These techniques especially lend themselves to the capabilities of microcomputers. The CORDIC technique also makes it easy to implement to DISCRETE Fourier transform (DFT.) The DFT can be viewed as a sum of rotated complex vectors. CORDIC techniques can be used to accomplish the rotation. As in most computers, in 77 type computers addresses are formed in the cpu. However, if address calculation is performed in a separate address control

[continuation of JISUANJI YANJIU YU FAZHAN No 2, 1982 pp 7-12]

unit, we can relieve the demands on the ALU, speed up the processing, and meet the address calculation needs of digital signal processing. This facilitates the implementation of the FFT [Fast Fourier Transform.] In order to facilitate the use of the signal processing computer the user is provided with the FFT statement. Its function is implemented by a program constructed from corresponding FFT instructions. The 77 type machine is composed of 2 components: the control memory and the arithmetic logic unit. This paper discusses extending this to 3 main parts: an expanded control memory, an ALU with parallel shift transmission, and an address control unit. This will enable a computer so organized to cover the area of application of both microcomputers and signal processing computers.

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TITLE: "A Microcomputer for Data Processing in Neurophysiological Research"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT]
in Chinese No 2, Feb 82 pp 31-37

ABSTRACT: Every kind of biological phenomenon displays bioelectrical activity but the laws of such activity are very difficult to master. For example, the human brain contains 10 billion neurons and any kind of neural activity activates electrical impulses of the neurons. In order to record this activity we put electrodes in the scalp. Computers are necessary to make sense of the mass of data so gained. In 1980, we developed a bioelectrical data processor (BDP.) The heart of the system was the single board Z80 Starter System, with expanded RAM and EPROM, a special keyboard and input-output and display unit. This article describes the design concepts and concrete implementation of this system. The special characteristics of bioelectrical data processing include the following: all kinds of processing is required; processing methods are continually advancing and changing; researchers require interactive control; the scale of current of biological research is not large;

[continuation of JISUANJI YANJIU YU FAZHAN No 2, 1982 pp 31-37]

and it requires a cost effective system. Based on these requirements, a number of design criteria were arrived at: a complex processing capability must be built out of basic processing steps; a monitor program residing in EPROM must be interfaced with utility programs; the program must be maintainable and modifiable; a microcomputer will provide the heart of the system. Using a single board microcomputer which costs 300 yuan and is expandable, the system can be built cheaply. The starter system used the 8-bit Z80 microprocessor, which includes the entire 8080 instruction set, making it easy to use 8080 software. This board is fairly complete. Aside from the CPU and 1 K RAM, it includes the parallel input/output Z80 PIO and the Z80-CTC timer circuit. It has a magnetic tape and a 28-key keyboard as well as a 2 K monitor in ROM. The RAM and ROM were expanded to a total of 16 K bytes. Two K bytes of RAM were used to hold bioelectrical data and processing results, 1/4 K held a run time monitor, and 5.75 K were used for data collection and utility programs, etc. Design of the system started in Mar 80 and it was basically completed in Dec and placed in operation in the bio-laboratory. The hardware all performed to standard. The system control program commonly used utility programs in EPROM totaled 7 K bytes. The operation of the system under laboratory conditions proved that the system design was reasonable, had great potential, and was suitable for the needs of scientific experimentation. The design concepts were relatively new, specialized, and cost effective. After the system was placed in the laboratory, the urgent need for new programs was revealed. We are now producing programs which are helping to raise the standard of biological research to approach international standards.

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TITLE: "A Discussion of Some Problems of the Power Systems for Large Scale Computers in China"

SOURCE: Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese No 2, Feb 82 pp 38-50

ABSTRACT: Third generation computers in China, like the 013, the HDS-9, etc. adopted 400 cycle or 1000 cycle medium frequency alternating current generators. The main advantages are: it provides good isolation from the power net; it is reliable; and alternating current generators are relatively mature products. As computers advanced, the electrical requirements increased. In the 60's in the rest of the world an uninterruptible power source (UPS) composed of a 3-phase inverter, storage batteries, and diesel generators was adopted. The storage battery could provide 15 to 30 minutes of power, after which, if needed, the diesel generator could be started. Because of its various advantages, this system was produced in China. China can now supply 50 cycle 3-phase inverters of 50 and 100 KVA, and 400 cycle inverters of 15 KVA. The circuits are third generation. Fourth generation circuits are being developed. Some people (especially experts in China) feel that most computers do not need UPS. It is only necessary to implement the CVCF (constant voltage, constant frequency) system. Abroad, there is a preference for CVCF over UPS. The

[continuation of JISUANJI YANJIU YU FAZHAN No 2, 1982 pp 38-50]

Chinese made BP-30 and BP-1000 medium frequency generators have been in practical use for over 10 years and proved to be reliable but the one defect is noise, generally above 90 db. This is not only a threat to maintenance people but interferes with the work people nearby. A direct current constant voltage source is the heart of a computer's electrical system. In order to improve electrical quality and decrease transmission interference as much as possible, this power source is often installed on the same board as the logic unit. Generally speaking, computers require a high reliability electrical source, with a high efficiency. In order to improve power source technology, experts in China and abroad are striving to find new and more effective techniques. A number of developments are noted. One of these is the use of rectifier filter direct current sources. Because the requirements of computers for direct current stability is not high, many countries adopt simple rectified current with filters as the computer power source. The CDC Cyber 172 uses this. The magnetic amplifier source is discussed. Also, at present many computers are using transformed direct current sources. At present a great deal of attention is being paid to shrinking the volume of the power source, raising reliability, and diminishing interference. Raising the frequency is an effective method and abroad frequencies of 200 KC is not novel. The unipolar motor is low voltage, high current equipment and meets the requirements of computers. The article concludes with a discussion of grounding considerations.

6166

CSO: 4009/277

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TITLE: "A Study on the Maximum Thrust Nozzle Surface of Solid Rocket Engine for One-Dimensional Two-Phase Flows"

SOURCE: Beijing BINGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 82 pp 1-9

ABSTRACT: Based upon the Pontryagin's maximum principle, this paper studies the problem of optimal thrust nozzle surface for one dimensional two-phase flows. Using the slope as the control variable, the optimal surface is proved to be a conical surface, formed by a rectilinear system with the slope as a constant. Methods for defining the optimal contour of the subsonic and the supersonic segments are also discussed. The paper concludes that in designing the thrust nozzle surface of one dimensional two-phase flows, the smallest possible value should be selected for the convergent half angle α of the subsonic segment, the greatest possible value should be selected for the expansion half angle β of the supersonic segment.

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TITLE: "Multiobjective Decision of Parameters for the Suspension System of a Wheeled Vehicle"

SOURCE: Beijing BINGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 82 pp 30-37

ABSTRACT: Based upon the random vibration theory, there are several different control standards to choose from for establishing the suspension system of a vehicle. As the optimization technique is becoming more popularly applied in engineering design work, it has also been introduced to resolve the problem of selecting parameters of the suspension system. The authors start with a mathematical model of an optimized design. Due to the fact that it is relatively difficult to find a solution to a multiobjective problem directly, scientists have proposed many methods to transform it into a uniojective problem. A method of the sum of linear weighting, a method of object formulation, and a method of the ideal point are introduced by the authors for the transformation before obtaining the optimized solutions on a computer. The mathematical model, the optimization procedure, and sample parameters are given.

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TITLE: "Comments on the Plateau Combustion Mechanism of Double-Base Propellants"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 82
pp 48-57

ABSTRACT: Theories concerning plateau combustion mechanism of double-base propellants, proposed by scientists of the USA, USSR, Japan, Great Britain, etc. are divided into 2 major categories for review purpose in the paper: the subsurface co-accreration phase theories and the gaseous phase theories. The first category is further divided into the photochemical reaction mechanism, the chemical equivalent shift theory, the chelation theory, the location and mechanism of activity of catalysts studied with the spectroscopic method, thermal decomposition-gaseous phase chromatographic studies, mass spectrographic analyses, differential calorimetric experiments, determination of explosion point to obtain activation energy, and results of surface temperature measurements. The second category is further divided into the lead-lead oxide cycle theory, the free base theory, the carbon-containing substance-the heated bright ball theory, the lead-carbon catalysis theory, the π bond complexing theory, the thermal plateau microscopic studies, and the theory of reaction unrelated or not greatly related to pressure. Proposals under each subcategory are commented separately and the 58 references, in which these proposals originally appeared, are provided. Finally, several viewpoints of the author concerning the direction of future researches on the subject are presented.

6248

CSO: 4009/266

AUTHOR: None

ORG: None

TITLE: "National Laser Electron Beam Heat Treatment Technology Discussion Meeting"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 1, 1982
p 26

ABSTRACT: The National Laser Electron Beam Heat Treatment Technology Discussion Meeting was held in Changchun from 29 Oct to 1 Nov 81, with 82 delegates representing various places of the nation. The conference received 27 papers. The delegates analyzed the condition of development of laser heat treatment in foreign countries and discussed the domestic conditions and problems of the field. They agreed that the technique has its special characteristics of saving energy, being free of pollution, high production efficiency, and minimal deformation of products. The technique is especially suitable for articles of complex shape and for surface hardening of a portion of an article of a relatively large size. CO₂ laser tube of less than 500W is believed to be sufficient to satisfy production needs but laser devices of more than 2000 W would be even more suitable. At present CO₂ laser devices of the 3-5 kw class should be developed and on that basis, experimental research and production application of such processes as alloying, glazing, coating, etc. should be carried out. The delegates suggest that a comprehensive research center should be established to organize the production of complete sets of laser tools and to supply them to the production units.

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TITLE: "Several Viewpoints Concerning Specialized Production of Heat Treatment in Talian City"

SOURCE: Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 1, 1982
pp 32-34

ABSTRACT: Talian is an industrial city of many industries, including machinery, petroleum, chemicals, instrumentation, electronics, metallurgy, shipbuilding, textiles, and whatnot. In the process of further readjustment of the national economy, the heat treatment industry, which exists to serve the aforementioned industries, is also undergoing readjustment. The current problems of the heat treatment industry include excessively scattered plants, low rate of equipment utilization, low technological level, backward equipment, and low average technical and economic indices. Based upon these conditions, the author suggests that some plants that have few jobs, low technical level, and high energy consumption should be closed down. Others that have been linked with cold and hot production lines should continue. For some industries, such as vehicles, machine tools, shipbuilding, etc. a center for heat treatment may be established to gather together good engineers and skilled workers in one place, so that the level of production management and technology may be improved, the cost may be reduced, and the attitude of service for the other industries may be introduced. Within permissible limits, the system of awarding bonuses may be implemented.

6248

CSO: 4009/280

Hydroelectric Power

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TITLE: "All Characteristics of the Mixed-phase Flow, Reversible Pump Turbine"

SOURCE: Beijing SHUILI SHUIDIAN JISHU [WATER CONSERVATION AND HYDROELECTRIC POWER TECHNOLOGY] in Chinese No 2, 20 Feb 82 pp 34-40

ABSTRACT: On the enclosed gas etching test stand of the Hydraulic Machinery Laboratory of Qinghua University, the authors carried out a steady-state all property test of the mixed flow reversible pump turbine to determine its properties under all 5 operation conditions; i.e. the pump, the turbine, and the pump braking, the turbine braking, and the reverse pump conditions of the transitory process. The water flow characteristics of the various operation conditions are introduced. All property curves are used to analyze some transitory states of the reversible machine. Results of the test are found to be very close to the properties of similar machines in foreign countries. In the future, further studies may be carried out to use theoretical or semi-theoretical computation method to draw the all property curves and a great deal of time may be saved in designing reversible turbines.

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TITLE: "Small Hydroelectric Power Resources in Fujian Province and the Condition of Their Utilization"

SOURCE: Beijing SHUILI SHUIDIAN JISHU [WATER CONSERVATION AND HYDROELECTRIC POWER TECHNOLOGY] in Chinese No 2, 20 Feb 82 pp 52-55

ABSTRACT: Fujian is an agricultural province of little land, numerous population, and a backward economy. It has no oil or gas and a small coal reserve. Its resources of small hydroelectrical power generation is the only objective condition for rapid development. Before the liberation, the province had 5 small hydroelectrical power stations of a total capacity of 505 kw. Now, it has more than 8 thousand stations of 677,000 kw of machine capacity, amounting to 21 percent of its total developmental potential. In the recent decade, the direction of development is toward expansion, linkage, and storage, depending mostly upon locally raised capital. The existing stations are mostly the runoff type, with great water volume variations. The supply and demand are often not in balance; the equipment utility rate is low; and accidents occur much too frequently. This paper describes the condition of development of small hydroelectrical power stations in Fujian, their economic indices, and the existing problems. Some solutions to the problems are briefly mentioned.

CSO: 4009/279

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TITLE: "Determination of the Alloying Amount of Ce and Its Distribution in Steels by Radioactive Tracer Method"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 1-7

TEXT OF ENGLISH ABSTRACT: The steel samples containing cerium sulfide and cerium oxide traced by ^{141}Ce were electrolyzed to detect the stability of cerium sulfide and cerium oxide under the chosen conditions of electrolysis. The results of our experiments show that the decomposed amount of cerium sulfide and cerium oxide during electrolysis is extremely small, the former being ≤ 0.4 percent and the latter ≤ 0.027 percent. The measurements of the cerium content in the five kinds of steel show: if the original content of S and O in steel before the addition of Ce is high, there is almost no dissolved cerium in the low Ce content steels. The alloying amount of Ce increases with the increase in Ce content in steels. Experimental results show that the method used by former researchers for determining the alloying amount of the rare earths by the difference between the total rare earth amount in the sample and the rare earth amount in the inclusions is unreliable due to the segregation of rare earth inclusions in the steel.

[Continuation of GANGTIE No 2, 1982 pp 1-7]

Microautoradiographs show that the inclusions containing cerium are more concentrated in pearlite of the as-cast 25MnTiB steel. Ce is distributed in a strip shape within the grains of as-cast Fe-Cr-Al alloy. The concentration of Ce in the grain boundaries was not observed by autoradiography.

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TITLE: "On the Reaction of Carbon-Oxygen and of Silicon-Oxygen During the Vacuum Smelting of Ultra Pure Ferritic Fe-Cr-Mo Stainless Steel"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 9-16

TEXT OF ENGLISH ABSTRACT: The effect of temperature, pressure and alloy concentration on the equilibrium of carbon-oxygen reaction for a ferritic Fe-Cr-Mo stainless steel was investigated. Results obtained by calculation show that either a lowering of the pressure or an increasing of the temperature promotes the carbon-oxygen reaction, but the presence of high chromium concentration retards the reaction. Similar calculation of the equilibrium value of silicon-oxygen reaction indicates that during the vacuum induction melting the concentrations of silicon and oxygen in the liquid bath closely approach their equilibrium values. From the calculated results it is concluded that the equilibrium concentration of silicon and carbon in the liquid steels is mainly dependent on the degree of vacuum employed as well as on the amount of oxygen present in the bath.

[Continuation of GANGTIE No 2, 1982 pp 9-16]

The experimental results obtained by electron beam melting and vacuum induction melting are cited to give rate values for the removal of carbon, silicon and oxygen respectively from the molten bath. It is shown that the rate-determining step for carbon removal is the diffusion of carbon across the boundary layer, whereas the rate of deoxidation by silicon depends mainly on the oxygen concentration in the liquid steel. Based on the above results certain suggestions to improve the technology of smelting have been proposed.

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TITLE: "A Water Model Study of Gas Injection in a Steel Ladle"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 17-22

TEXT OF ENGLISH ABSTRACT: A hydraulic model experiment has been carried out simulating powder injection into a 15 t ladle with argon. The effects of argon flow rate, lance position and nozzle configuration on the flow pattern of the liquid were studied. A KCl solution was used as a tracer for the measurement of time of mixing. The relationship between gas rate and depth of lance immersion has been obtained. The effect of lance location relative to the central axis of the vessel is discussed.

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TITLE: "Technological Studies for the Extraction of Niobium and Manganese from Baotou Hot Metal"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 23-30

TEXT OF ENGLISH ABSTRACT: Hot metal from Baotou blast furnaces contains about 0.08 percent of niobium and 1 percent manganese. The open-hearth slag accumulated at that steel plant also retains appreciable amounts of these metals. A process has been developed, using a small blast furnace and side-blown converter for collecting niobium and manganese in the OH slag into an enriched intermediate slag, which is used as the raw material for the production of ferro-manganese-niobium. Methods were also experimentally studied for the direct extraction of niobium and manganese from the hot metal. It was found that by properly treating the hot metal in a converter, be it top-blown, side-blown or bottom-blown, at least 80 percent of the niobium and manganese is oxidized, producing a slag which is in effect an artificial niobiferrous manganese ore, that can be used for making niobiferrous ferro-manganese especially suitable for the production of niobium microalloyed high-strength steel. A bottom-blown converter is preferable to the side- or top-blown in that less of the phosphorous will go into the slag, thus simplifying the latter subsequent processing. A neutral lining (e.g., high alumina brick) would have the

[Continuation of GANGTIE No 2, 1982 pp 23-30]

advantage of longer life and higher Nb and Mn as well as lower P content in the slag produced. Large-scale tests of a continuous spray extraction process pointed toward considerable potential advantages over the intermittent converter processes.

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TITLE: "Selective Oxidation of Niobium and Some Other Related Elements in Liquid Iron"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 2, 1982 pp 31-35

TEXT OF ENGLISH ABSTRACT: Recovering niobium from hot metal is a process of complex selective oxidation. Based on the work of the authors' research group, this paper deals with the niobium oxide formed in slag, the oxidation of elements in liquid iron, the optimum temperature of selective oxidation for recovering niobium, the influence of (FeO) upon selective oxidation, the length of oxygen jet in the bath, the time for perfect mixing in the bath, and gives some useful conclusions.

9717
CSO: 4009/283

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TITLE: "The TP801-280 Single Board Microcomputer"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, 82 pp 5-9

ABSTRACT: In order to promote the use of microcomputers the Beijing Industrial University, in cooperation with the Jingye Company of Hong Kong, has developed an inexpensive and efficient TP801-280 single board microcomputer. It can be used for process control, instrumentation, and data processing as well as in distributed processing. The major characteristics are as follows: It uses the 280 CPU; the clock cycle is 1.9968 MHz, making it convenient for use with an 8080 interface circuit. The 4K bytes of RAM is composed of 8 2114 chips; 2K bytes of ROM include the TIRUG-A monitor; 4K bytes of PROM or EPROM can be selected. The I/O is carried out through the 280-P10; there are 2 8-bit programmable I/O ports; there is a 280-CTC arithmetic timer unit. There are 28 keys, 16 of which are hexadecimal keys and 12 are command keys, including 8 dual function keys. The 280 CPU is described in some detail, such as the fact that it has 158 basic instructions, including the 78 8080 instructions. Its addressing scheme and interrupt structure are outlined. Memory organization is described in some detail, such as the fact

[continuation of DIANZI KEXUE JISHU No 2, 82 pp 5-9]

that ROM locations 0-07FFH (i.e. 7FF hexadecimal) contain the monitor and locations 800-F 17FF contain utility programs. The MOVE, LAST, AND DISK commands are described in some detail. The article concludes that the TP801 can satisfy many industrial needs, but efficiency of using machine language in the editing and testing of programs is low. The TP80 series, TP803, can overcome these contradictions.

6168

Q30: 4009/269

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TITLE: "Research on the Reconstruction of the Technical Process of Chaoyang Asbestos Ore Dressing Plant"

SOURCE: Beijing FEIJINSHU KUANG [NONMETALLIC ORES] in Chinese No 1, 28 Feb 82
pp 6-9

ABSTRACT: The Chaoyang Asbestos Deposit is an underground mining site. As the production advances toward the deeper parts of the deposit, the condition of the ore reserve, the quality, the fiber length, and the asbestos elasticity are all changing while the water content of the ore is increasing. These conditions have been giving some difficulties to the ore dressing process. Based upon the physical properties of the ores, the reconstructed dressing process is divided into the 2 parts of ore preparation and the crude ore refining process. At present, due to the great differences of ore characteristics produced from the various asbestos mines in China, the dressing processes are becoming more and more complex. The reconstructed Chaoyang Dressing Plant is designed for an annual production of 8,000 tons. Although it remains a small scale plant, the dressing equipment used in the selection and purification processes is designed and made by the plant itself. This special characteristic has caused the work procedure to be simplified yet the goal of separating the asbestos fiber from the gangue and the powdery dust is achieved. A flow diagram of the reconstructed process is included.

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TITLE: "Preliminary Investigation on the Technique of Dressing the Wollastonite of the Taye-Yangxin Region of Hubei Province"

SOURCE: Beijing FEIJINSHU KUANG [NONMETALLIC ORES] in Chinese No 1, 28 Feb 82
pp 10-14

ABSTRACT: In foreign countries, Wollastonite or tabular spar (CaSiO_3) has been used as an industrial raw material for 2 to 3 decades; in China, the discovery of industrial scale deposits of this mineral is only a matter of very recent years. With the development of the national economy, there is a need of accelerating the production of glazed tiles for which Wollastonite is a relatively ideal raw material. Based upon foreign reference materials, including those of the USA and the USSR, the author and colleagues completed some preliminary experiments on dressing the ores produced in the Taye-Yangxin region. This paper includes a description of the general characteristics of the ores, results of spectroscopic semi-quantitative analysis, results of chemical analysis, the thermal properties of the ores, and the contents of harmful foreign substances. The experimental dressing formula and the results are reported. There is also a brief report on the experimental application of the dressed mineral to make glazed tiles.

6248
CSO: 4009/282

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TITLE: "The Method of Panoramic Moire Topography"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT]
in Chinese No 1, 1982 pp 3-9

TEXT OF ENGLISH ABSTRACT: This paper presents a new method which is called panoramic Moire topography. This method can take a 360° panoramic topograph of an object with a synchronous slit camera while the object is rotating about its center relative to a fixed flat grid. The principle and method for generating panoramic topography are described. The formulas, error analysis of contouring fringes and the experimental devices are explained. We get the panoramic topography of the "boy's head" model and the conic cylinder by this method. The comparison of the experimental values of the conic cylinder with the theoretical values shows that the error is less than 40.05 mm

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TITLE: "Resonant Photoelectron Appearance Potential Spectroscopy"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT]
in Chinese No 1, 1982 pp 10-17

TEXT OF ENGLISH ABSTRACT: Excitation of core-level electrons may occur through a resonant absorption of characteristic X-rays from a built-in X-ray tube with an anode made of the same material as that of the sample. Auger electrons may be generated during the deexcitation process. By measuring the total yield of photoelectrons as a function of anode voltage, a new type of appearance potential spectroscopy (APS), the resonant photoelectron appearance potential spectroscopy (RPAPS), is obtained. Compared with the soft X-ray APS, RPAPS has the advantage of better sensitivity for the sub-peaks of principal element and peaks for the impurities under the same operating condition. RPAPS causes no damage to the sample, therefore it can be used in the whole range of energy of APS. Results from pure nickel and nickel alloys are given for demonstration.

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TITLE: "Some Aspects of Analog Input Channel"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT]
in Chinese No 1, 1982 pp 18-26

TEXT OF ENGLISH ABSTRACT: Analog input channel is one of the crucial parts in the utilization of computers for automatic measurement and control. Currently there are practical difficulties remaining to be resolved in the hook-up of the component to certain systems. During the development of the G3 Data Acquisition/Processing Control System, we experienced these difficulties also, and present them in this report as follows: The analog switch is the fundamental part of the channel. We adopted a tube-type, optoelectrocoupling-MOS circuit analog switch. In theory, this is an ideal type for the analog switch. Its performance has been confirmed by our practice. During the test-runs of the G3 system, we found that the channel interference phenomena persisted. After conducting substantial tests and careful analyses of the results, we came up with a way of suppressing the interference. Tests were performed and summarized for the key factor, the temperature coefficient, of the transducer's constant-current source that might affect the measurement accuracy. We find that the temperature coefficient would depend on performances of the operation amplifier. The success of choosing an appropriate amplifier

[Continuation of YIQI YIBIAO XUEBAO No 1, 1982 pp 18-26]

enables us to resolve the difficulty in the application of a new type of semiconductor transducer. Through experiments we have come up with a way to prevent voltage overloading. By the four pairs of transistor modulating/demodulating analog switches in the data amplifier, we found that the selection and distribution could simply be carried out according to the reversed current amplification coefficient.

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TITLE: "The Combination Method of the Limit Values of Error"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT]
in Chinese No 1, 1982 pp 27-33

TEXT OF ENGLISH ABSTRACT: This paper proves that the rule of square sum is valid for the combination of the limit values of the terms of probability distribution, thus solving a protractedly debated problem in the theory of error. The analysis in this paper is based on three premises: (1) It is recognized that the outlier may occur, but its influence on the quality of measuring results is small. (2) The quadratic moment of outlier is introduced to replace the probability of outlier (or confidence level) and should be regarded as a major mathematic index for estimating the degree of seriousness of the outlier. (3) It is believed that the considerably large values occur in the error terms, which seriously deviate the normal distribution, with little probability. Moreover, when estimating the reliability of combination methods, the influence of this probability is taken into consideration.

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TITLE: "The Optical System Design of a Versatile Laser Interferometer"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT]
in Chinese No 1, 1982 pp 34-39

TEXT OF ENGLISH ABSTRACT: Making use of the advantages of lasers, we have developed a versatile polarized laser interferometer of high precision but with simple operation. A quarter wave-plate and polarizing beam-split prism system is applied so that this instrument can adjust the contrast of interference fringes and eliminate the adverse effects of the stray light reflected from surfaces of the interferometer. The design of this instrument and some of its experimental results are given here. The method of realizing uniform inclination interference measurement with one of the interchangeable objectives of testing the spherical mirror, the apparatus of quick fringe acquisition and the double rhomboid-prism alignment system designed for operating with ease are also described.

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TITLE: "An Analog Optical Method for Image Equidensity Level Slicing"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT]
in Chinese No 1, 1982 pp 40-46

TEXT OF ENGLISH ABSTRACT: Recently, optical image processing with its ability for parallel-processing, large data capacity and low cost has become a prominent branch of image processing techniques. In this paper, a halftone technique applied to equidensity-level-slicing of wider density thickness in order to isolate the specified density area of an input image is described. This method is different from that previously used where a one-dimensional-halftone screen (S_2) consisting of rectangular halftone cells is chosen. The halftone screen (S_1) chosen here consists of halftone cells with nonmonotonic and abruptly jumping characteristics which can perform pulse-frequency-modulation on the input, thereby achieving the transformation from the specified density to the special frequency. Thus, by using a quasi-coherent processing system, the special filtering to abstract the specified density areas can be accomplished. The hard-clipping preprocessing consists of using the halftone screen of fundamental frequency 7.51 p/mm, spatial-frequency-product 450, "So" high-contrast film and "D₉" developer. The experimental results

[Continuation of YIQI YIBIAO XUEBAO No 1, 1982 pp 40-46]

of the equidensity abstracted from a satellite remote sensing image are shown in the pictures. What we want to achieve by level slicing is an ideal rectangular intensity transfer function (ITF). However, since the hard-clipping property of the film used is by no means ideal and the line blooming is unavoidable in the halftone picture, the level slicing ITF actually obtained had to be degraded. In this work, the level slicing ITF of the one-step film copying process of S_1 , S_2 and the slice density thickness is measured experimentally. The degree of degradation of ITF for S_1 , S_2 is determined individually by comparison with the ideal ITF. The comparison of the level slicing performed by S_1 , S_2 demonstrates that the quality of level slicing ITF has been improved and the line blooming has been reduced. Judging by the experimental results of the equidensity abstracted from the satellite remote sensing image, the corresponding boundaries of gray steps are clear. This proves that these slices are independent and there is no cross-over. Therefore, the original purpose of isolating the specified density area has been achieved. From this work we see that this method of level slicing by using halftone technique may be successfully applied in other regions.

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TITLE: "An Analysis and Design of Binary-to-N-nary System Decoding Network with Voltage-stabilizing Supply"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 47-56

TEXT OF ENGLISH ABSTRACT: The binary-to-N-nary system decoding network with voltage-stabilizing supply may be classified into four types: ladder-ladder, ladder-weighting, weighting-ladder and weighting-weighting.

In this paper, a new method of analyzing the decoding network has been established. In comparison with the previous methods, the advantage of the present one is its simplicity. In addition, it can be used for general purposes. A series of design formulas are described. Some examples are given to make this method more available.

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TITLE: "The Theoretical Analysis and Calculation of Magnetic Modulator"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 57-63

TEXT OF ENGLISH ABSTRACT: At present the magnetic modulator is very extensively applied to the precise instruments of electrical measurement, but the theoretical analysis on the magnetic modulator as of yet has not been quite perfect. Two simple analytical methods, the breaking line method and the hyperbolic function method, are presented and are compared through analysis. The hyperbolic function method has been shown to have a more guiding effect in practice.

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TITLE: "An Investigation of the Auto-design Method for the Primary Construction of Optical Systems"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 64-68

TEXT OF ENGLISH ABSTRACT: This paper introduces a method of automatic design for the primary construction of optical systems. This method is based on Delano's $y-y$ mathematical model and employs the statistic test method with iteration process. By using this method satisfactory results have been obtained. In this paper, the mathematical method, construction of merit function and use of the program are discussed in detail, and the calculated results are also given.

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TITLE: "An Automatic Hollow Cathode Light Source Device for Emission Spectrum"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese No 1, 1982 pp 69-75

TEXT OF ENGLISH ABSTRACT: The theory and practice of the ZKG-1 automatic hollow cathode light source for the emission spectrographic determination of trace elements in steels, high temperature alloys, nonferrous metals and superpure substances are described in detail. The questions investigated include high voltage electrical source unit for constant current output, dynamic equilibrium-type vacuum system and program control system. Supplying a hollow lamp with pulse current or a combination of pulse current and direct current can improve the limits of detection for some elements. When He is replaced by Ar on the cheap, spectral emission intensity of a large number of trace elements is changed insignificantly. The absolute limits of detection for a large number of trace elements are 10^{-6} ~ 10^{-11} g. The relative limits of detection are 10^{-3} ~ 10^{-6} percent. A coefficient of variation detected is 10-50 percent.

AUTHOR: ZHU Guoyi [2612 2654 6654]
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TITLE: "A Multi-purpose Neopolarograph"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT]
in Chinese No 1, 1982 pp 76-84

TEXT OF ENGLISH ABSTRACT: A multi-purpose neopolarograph system has been designed. The system consists of recording $i-E$, $m-E$, $e-E$, $e'-E$, $e''-E$ and cyclivoltammetric curves, where m and e are semioperators, the semiintegral and semidifferential, e' and e'' are the 1.5th order and 2.5th order differential. The principles, construction and experimental results are given. It shows that the sensitivity, resolution, reproducibility and rapidity of the system are satisfactory.

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TITLE: "State-space Mathematical Model of Split-shaft Gas Turbines and a General Computer Program for Dynamic Study of Control System"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT]
in Chinese No 1, 1982 pp 85-94

TEXT OF ENGLISH ABSTRACT: The gas turbine is a nonlinear, multi-input and multi-output power system. The increase of the number of shafts and the number of control parameters, together with their corresponding control loops, makes the gas turbines as a control object more and more complicated. This paper presents a study of the dynamic behavior of split shaft gas turbines with regenerator and adjustable nozzles by the modern control theory. With the detailed consideration of the physical phenomena which take place in transient response, five differential and six algebraic equations describing the dynamic behavior are deduced and, through some special transformations, a mathematical model of split shaft gas turbines in state-space form is obtained. On the basis of this state-space mathematical model, this paper presents a common computer program for the dynamic study of different split-shaft gas turbines with different control rules. This mathematical model may also be used for the optimal control of split-shaft gas turbines.

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TITLE: "Prospects for Process Analyzers of the 80's"

SOURCE: Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT]
in Chinese No 1, 1982 pp 95-101

TEXT OF ENGLISH ABSTRACT: The process analyzers (PA) are undergoing rapid changes. In this paper, the most important trends of development of PA are reviewed for the purpose of giving a general picture of the PA of the 80's. The application of microprocessors in the design of PA is most fascinating. It will be extended to a lot of simpler, monocomponent PA, such as pH meters, ion activity meters, conductometers, nondispersive IR gas analyzers, etc., for correcting baseline shift, calibrating, data processing, compensating for errors resulting from changes of background composition of sample and environmental conditions, controlling instrument operation and monitoring instrument working status, etc., in the next few years, although their use today is primarily limited to several types of multicomponent PA. With the exception of the gas chromatograph, the use of process multicomponent analyzers, especially liquid chromatographs, mass spectrometers, multicomponent IR analyzers and X-ray analyzers, will grow quickly. More and more efforts have been directed toward the exploitation and development of simple selective direct probes. The weakness of early developed direct probes was

[Continuation of YIQI YIBIAO XUEBAO No 1, 1982 pp 95-101]

lessened or overcome due to the adoption of microcomputers. The most attractive direct probes include ion-selective electrodes, solid state electrochemical transducers and optical probes. Composite probes integrated with microcomputers with the ability of eliminating complicated interference influence by mathematical compensation will be available. Another noteworthy trend is that great attention is paid to system design and the auxiliary parts of the analyzer systems. "Prepackaged analyzer systems" were born in time, and some changes in the concept, technology and hardware designs of sampling and sample pretreatment are expected to take place.

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CSO: 4009/286

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TITLE: "Simultaneous Measurement of Profiles of Deep Levels and Shallow Impurities with the C-V Method"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 89-94

TEXT OF ENGLISH ABSTRACT: The measurement of the profile of deep levels in semiconductors as well as that of the profile of shallow impurities is a problem of great importance. We suggest a procedure for measuring simultaneously the profile of deep levels and shallow impurities with the C-V method. The results are especially accurate when the density of the deep levels is comparable to that of shallow impurities. The principle and method of measurement is presented and we give results of measurements on an N⁺-P junction of gold-doped silicon and on a Schottky barrier of VPE N-type GaAs.

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TITLE: "Investigation Methods of Lapping and Polishing Damages in Single Crystal Wafers by X-ray Double- and Triple-crystal Diffractometry"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 95-101

TEXT OF ENGLISH ABSTRACT: Methods using X-ray double- and triple crystal diffractometry for the investigation of lapping and polishing damages in single crystal wafers have been suggested. Depth of lapping damage in semiconductor wafers can be measured quantitatively by double-crystal diffractometry and successive etching of wafer surface. The quality of polishing of single crystal wafers can be detected non-destructively by double- or triple-crystal diffraction methods, and comparison can be made between different ways of polishing. No change over of reference wafer is required in the proposed triple-crystal diffraction method when polishing quality of various kinds of specimen wafers is to be examined quickly and effectively.

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TITLE: "Rapid Determination of Bulk Generation Lifetime and Surface Generation Velocity by Saturation Capacitance Method"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 102-106

TEXT OF ENGLISH ABSTRACT: A new rapid method for determining bulk generation lifetime and surface generation velocity is suggested on the basis of the analysis of a MOS capacitance $C-t$ transient response to a linear voltage sweep. Both the experimental procedure and the calculation involved are relatively simple, therefore the method is more suitable for cases in which measurements of lifetime and surface generation velocity of a large number of samples are necessary.

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TITLE: "A Study of Doping Effects on 1.3 μm InGaAsP/InP DH Laser by means of SEM and $V-I$ Characteristic"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 107-112

TEXT OF ENGLISH ABSTRACT: The doping effects on the position and properties of PN junction in 1.3 μm InGaAsP/InP laser by means of SEM and $V-I$ characteristics are studied. It is considered that Zn vapor contamination during the epitaxial growth and Zn fast diffusion of Zn doped InGaAsP, InP crystals is the dominant cause for PN junction deviation and that a high concentration of donor or acceptor dopant will result in a tunneling-type of PN junction. Therefore, in the fabrication technology of lasers, control of Zn contamination and dopant concentration is of extreme importance.

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TITLE: "The Dependence of the Electro-optical Delay Time on Injection Pulse Current in DH Lasers and Their Measurements"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 115-119

TEXT OF ENGLISH ABSTRACT: The expression for the dependence of the electro-optical delay time on the injection pulse current level and the front edge rise time was derived. The measurement of a stripe-type DH laser made by proton bombardment has been carried out by using the measurement system designed by us. For device 90-15#, at the current level 1.5 times the pulse threshold current ($I = 1.5 I_{th}$), the electro-optical delay time t_d was measured to be 4 ns, and the spontaneous recombination lifetime, τ_{sp} , was 3.2 ns. Some measurements were carried out with a DC bias. For several additional devices more results have been obtained. It can be seen that the measured results agree well with the theoretical ones.

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TITLE: "Development and Application of LC3 Ion Implanter"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 120-126

TEXT OF ENGLISH ABSTRACT: This paper presents a discussion on the physical design of LC3, and describes the main problems in the process of adjustment together with methods for solving them. It also gives a brief description of the results of adjustment and of the application of this implanter.

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TITLE: "Automatic Selection of Basic Units in LSI CAD Mask Making"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 127-135

TEXT OF ENGLISH ABSTRACT: This article describes the automatic selection of basic units during CAD mask making with double platen pattern generator and it puts forward an object function for basic units selection and an approach for the comparison between the two parameter sets used to differentiate mask graph units. It also suggests two basic partition models of mask graph units and the concept of the minimal integral partition threshold for their control. Finally, it discusses the logical process of automatic selection and the incorporation of all equivalent graph sets during the process.

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TITLE: "Study of High Dose Nitrogen Ion Implanted Layer on Silicon Surface"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 2, 1982 pp 136-140

TEXT OF ENGLISH ABSTRACT: This paper presents a study of the high resistivity layer formed by high dose nitrogen ion implantation on silicon surface. This study will be helpful in adopting ion implantation in the isolation technology for semiconductor integrated circuits.

N-type monocrystalline silicon with resistivity of 0.5 Ω -cm and $\langle 111 \rangle$ orientation is used as a substrate. The implantation energy used is 80 keV with high dose $1-2 \times 10^{17} \text{ cm}^{-2}$. After the implantation and annealing, a high resistivity layer with good stability in physical, chemical and electrical properties is formed on the surface of the substrate.

The crystal structure and the stoichiometry is analyzed by means of Auger electron spectroscopy (AEX), Rutherford channelled and nonchannelled backscattering, infrared Fourier spectrometer and X-ray photoelectron spectroscopy.

[Continuation of BANDAOTI XUEBAO No 2, 1982 pp 136-140]

The results prove that the implanted nitrogen ions have a Gaussian-shaped distribution and the amorphous nitride layer may consist of a matrix of silicon nitride and silicon.

The same results can be obtained by high dose nitrogen ion implantation on P-type $8-10 \Omega\text{-cm}$ silicon surface.

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CSO: 4009/288

Welding

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TITLE: "Experimental Studies of Electron Beam Welding of Alumina to Niobium"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 129-134

TEXT OF ENGLISH ABSTRACT: Experiments on the electron beam welding of alumina to niobium were carried out to obtain long-life ceramic-metal joints subject to corrosive working medium at high temperatures. Research on the design of welded components and on the technology of preheating and welding was made. Results of the performance tests of the welded joints were given. The mechanism of this type of EB welding was preliminarily analyzed.

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TITLE: "An Inquiry into the Rational Notch Depth of the Implant Test Specimen"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 135-142

TEXT OF ENGLISH ABSTRACT: The present report summarized the work on the susceptibility to hydrogen embrittlement of steel by C.L.M. Cottrell, F. Watkinson, et al., utilizing round notched tensile test specimens in a chamber filled with high pressure hydrogen. The specific type of implant test specimen as recommended by IIW (round specimen, 8 mm diameter, 40° notch, <0.1 mm root radius, 0.5 mm notch depth) was analyzed and its shortcomings cited. The influence of notch depth on notched tensile strength of 15MnVN steel in the normalized, thermal-simulated and welded states was investigated.

In this paper the authors present an expression D for the susceptibility of steel to hydrogen induced cracking, as indicated by the difference in reduction of notched tensile strength caused by hydrogen, i.e.,

$$D = \frac{\sigma_{NT} - \sigma_{T.H.}}{\sigma_{NT}} \cdot 100\%.$$

[Continuation of HANJIE XUEBAO No 4, 1981 pp 135-142]

The authors also give an example of taking the D value as a criterion for comparing two different postheat procedures and choosing the one suitable for making certain welded pressure vessels free from hydrogen-induced cracking.

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TITLE: "Study on the Delayed Cracking of Ultra High Strength Steel"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 143-151

TEXT OF ENGLISH ABSTRACT: The hydrogen induced cracking and the stress corrosion cracking in weld joints of 37SiMnCrMoV steel are investigated by means of four-point bending test and surface crack test respectively. High environment humidity increases the susceptibility to hydrogen induced cracking and stress corrosion cracking. Scanning electron microscope fractography shows the intergranular character of hydrogen induced cracking. The effect of microstructure of HAZ (partially melted zone and quenched zone) on cracking susceptibility is studied by the scanning electron microscope and optical microscope. Welding procedures are adjusted to prevent brittle failure of high pressure vessel.

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TITLE: "Study on the Automatic Regulation of TIG Welding Arc-length"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 152-160

TEXT OF ENGLISH ABSTRACT: The arc-length control device for TIG welding described in this paper has a closed-loop circuit voltage control and an open loop circuit servo-motor speed control. It is simple in construction and reliable in service. The servo-motor, powered by a transistor bridge, suffers no trouble from relay contactors and, therefore, makes the life of the device much longer. The amplification factor of this system is over 10^6 and the accuracy of voltage control is within ± 0.114 V.

The static process of arc-length regulation has been analyzed, thus providing a theoretical basis for the design of an apparatus of this kind. The production experience in the past two years has proved that this device is a very useful tool for TIG welding.

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TITLE: "The Design and Analysis of Electron Optical System for Electron Beam Welding Machine"

SOURCE: Harbin HANJIE XUEBAO [TRANSACTIONS OF THE CHINA WELDING INSTITUTION] in Chinese No 4, 1981 pp 161-170

TEXT OF ENGLISH ABSTRACT: In this paper, the physical factors of the formation of an electron beam spot in an electron optical system were analyzed. Through complicated analysis and calculation we obtained the basic rules of choosing a convergent half angle, an optical system and lens parameters, and learned their effects on the beam spot size. The said analysis and calculating method are also useful for the design of the electron optical system of EB welding machines.

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